VIA EFS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of: Yoshiaki Tanaka			
Conf. No.:	4884	Group Art Unit:	1742
Appln. No.:	10/654,099	Examiner:	Michael P. Alexander
Filing Date:	September 3, 2003	Attorney Docket No.:	10844-31US (203055(C-1))
Title:	Alloy Type Thermal Fuse and Material for a Thermal Fuse Element		

AMENDMENT AFTER FINAL

This is in response to the final Office Action dated May 9, 2006 (Paper No. 20060501). This response is being timely filed by August 9, 2006.

Please amend the above-identified application, without prejudice, as follows:

Amendments to and Listing of the Claims:

Please cancel claims 1 and 2 so that the claims read as follows:

1-2. (canceled)

3. (previously presented) An alloy type thermal fuse comprising a thermal fuse element having an alloy composition in which Sn is greater than 46 weight % and less than or equal to 70 weight %, Bi is at least 1 weight % and less than or equal to 12 weight %, and In is at least 18 weight % and less than 48 weight %, and wherein the composition does not intentionally contain an element which is harmful to a living body.

4. (previously presented) An alloy type thermal fuse comprising a thermal fuse element wherein 0.1 to 3.5 weight parts of one, two or more elements selected from the group consisting of Ag, Au, Cu, Ni, Pd, Pt, Sb, Ga, and Ge are added to 100 weight parts of an alloy composition in which Sn is greater than 46 weight % and less than or equal to 70 weight %, Bi is at least 1 weight % and less than or equal to 12 weight %, and In is at least 18 weight % and less than 48 weight %, and wherein the composition does not intentionally contain an element which is harmful to a living body.

5. (original) An alloy type thermal fuse according to claim 3, wherein said fuse element contains inevitable impurities.

6. (original) An alloy type thermal fuse according to claim 4, wherein said fuse element contains inevitable impurities.

7. (original) An alloy type thermal fuse according to claim 3, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

8. (original) An alloy type thermal fuse according to claim 4, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

9. (original) An alloy type thermal fuse according to claim 5, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

10. (original) An alloy type thermal fuse according to claim 6, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

11. (original) An alloy type thermal fuse according to claim 3, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

12. (original) An alloy type thermal fuse according to claim 4, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

13. (original) An alloy type thermal fuse according to claim 5, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

14. (original) An alloy type thermal fuse according to claim 6, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

15. (original) An alloy type thermal fuse according to claim 7, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

16. (original) An alloy type thermal fuse according to claim 8, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

17. (original) An alloy type thermal fuse according to claim 9, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

18. (original) An alloy type thermal fuse according to claim 10, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said

cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

19. (withdrawn) An alloy type thermal fuse according to claim 3, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

20. (withdrawn) An alloy type thermal fuse according to claim 4, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

21. (withdrawn) An alloy type thermal fuse according to claim 5, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

22. (withdrawn) An alloy type thermal fuse according to claim 6, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

23. (original) An alloy type thermal fuse according to claim 3, wherein a heating element for fusing off said fuse element is additionally disposed.

24. (original) An alloy type thermal fuse according to claim 4, wherein a heating element for fusing off said fuse element is additionally disposed.

25. (original) An alloy type thermal fuse according to claim 5, wherein a heating element for fusing off said fuse element is additionally disposed.

26. (original) An alloy type thermal fuse according to claim 6, wherein a heating element for fusing off said fuse element is additionally disposed.

27. (original) An alloy type thermal fuse according to claim 7, wherein a heating element for fusing off said fuse element is additionally disposed.

28. (original) An alloy type thermal fuse according to claim 8, wherein a heating element for fusing off said fuse element is additionally disposed.

29. (original) An alloy type thermal fuse according to claim 9, wherein a heating element for fusing off said fuse element is additionally disposed.

30. (original) An alloy type thermal fuse according to claim 10, wherein a heating element for fusing off said fuse element is additionally disposed.

31. (original) An alloy type thermal fuse according to claim 11, wherein a heating element for fusing off said fuse element is additionally disposed.

32. (original) An alloy type thermal fuse according to claim 12, wherein a heating element for fusing off said fuse element is additionally disposed.

33. (original) An alloy type thermal fuse according to claim 13, wherein a heating element for fusing off said fuse element is additionally disposed.

34. (original) An alloy type thermal fuse according to claim 14, wherein a heating element for fusing off said fuse element is additionally disposed.

35. (original) An alloy type thermal fuse according to claim 15, wherein a heating element for fusing off said fuse element is additionally disposed.

36. (original) An alloy type thermal fuse according to claim 16, wherein a heating element for fusing off said fuse element is additionally disposed.

37. (original) An alloy type thermal fuse according to claim 17, wherein a heating element for fusing off said fuse element is additionally disposed.

38. (original) An alloy type thermal fuse according to claim 18, wherein a heating element for fusing off said fuse element is additionally disposed.

39. (withdrawn) An alloy type thermal fuse according to claim 19, wherein a heating element for fusing off said fuse element is additionally disposed.

40. (withdrawn) An alloy type thermal fuse according to claim 20, wherein a heating element for fusing off said fuse element is additionally disposed.

41. (withdrawn) An alloy type thermal fuse according to claim 21, wherein a heating element for fusing off said fuse element is additionally disposed.

42. (withdrawn) An alloy type thermal fuse according to claim 22, wherein a heating element for fusing off said fuse element is additionally disposed.

43. (withdrawn) An alloy type thermal fuse according to claim 3, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

44. (withdrawn) An alloy type thermal fuse according to claim 4, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

45. (withdrawn) An alloy type thermal fuse according to claim 5, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

46. (withdrawn) An alloy type thermal fuse according to claim 6, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse

element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

47. (withdrawn) An alloy type thermal fuse according to claim 7, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

48. (withdrawn) An alloy type thermal fuse according to claim 8, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

49. (withdrawn)An alloy type thermal fuse according to claim 9, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

50. (withdrawn) An alloy type thermal fuse according to claim 10, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

51. (withdrawn) An alloy type thermal fuse according to claim 3, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

52. (withdrawn) An alloy type thermal fuse according to claim 4, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

53. (withdrawn) An alloy type thermal fuse according to claim 5, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

54. (withdrawn) An alloy type thermal fuse according to claim 6, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

55. (withdrawn) An alloy type thermal fuse according to claim 7, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

56. (withdrawn) An alloy type thermal fuse according to claim 8, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

57. (withdrawn) An alloy type thermal fuse according to claim 9, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

58. (withdrawn) An alloy type thermal fuse according to claim 10, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

REMARKS

Claims 3-58 are presently pending in the application. Claims 19-22 and 39-58 remain withdrawn from consideration. Claims 3-10 and 23-30 are generic.

Claims 1 and 2 have been canceled. No new matter has been added by this amendment. Further, since this amendment merely cancels rejected claims, entry after final is deemed appropriate and respectfully requested.

Objection and Formal Rejection

In the Office Action, the Examiner has objected to claim 2 as being of improper dependent form. Claim 2 has been canceled by this amendment, rendering this objection moot. Withdrawal of the objection is respectfully requested.

The Examiner has rejected claims 3-18 and 23-28 under 35 U.S.C. § 112, second paragraph, as being indefinite with regard to the phrase "wherein the composition does not intentionally contain an element which is harmful to a living body." The Examiner argues that one skilled in the art would not be able to determine the scope of which elements are to be excluded. The Examiner has cited four references which discuss the toxic effects of Sb, Cu, Ni, and Ag in living bodies, and notes that claim 4 specifically includes these elements in the claimed composition despite their known toxic effects. Applicants respectfully traverse this rejection as follows.

As explained in the present specification, there is a growing trend to prohibit the use of materials which are harmful to a living body. Therefore, alloy type thermal fuses preferably do not intentionally contain elements which are harmful to people involved in manufacturing the fuses or end-users of such fuses. In February 2003, the European Union adopted the Restriction of Hazardous Substances Directive (RoHS), which restricts the use of Pb, Hg, Cd, Cr^{6+}, PBB and PBDE in electrical and electronic equipment to 0.1% by weight, or 0.01% by weight for Cd (see attached Appendices 1 and 2). Similar legislation has been introduced in the United States (see Appendix 3). Further, in California, new recycling fees have been imposed on electronic waste due to the presence of Cd, Hg, and Pb in these products, which must be disposed of properly (Appendix 4). Thus, the purpose of the presently claimed invention is to restrict such elements, which are known to be harmful when included in electrical or electronic devices.

The Examiner takes the position that Sb, Cu, Ni, and Ag are known to be harmful, and that these elements should arguably be excluded as well. However, it is well known that any element, when ingested or administered in the wrong amount, can be harmful to a living body. However, there is no need to limit such elements in electronic and electrical devices, and the elements delineated by the Examiner have not been included in the RoHS directive, for example. Therefore, these elements would not be considered by one skilled in the art to be questionable when used in a material for electronic or electrical equipment, and one skilled in the art would clearly understand that the elements which are excluded from the presently claimed invention are those which are known to be harmful when included in electronic devices. Accordingly, it is respectfully submitted that the claims are definite and in full compliance with § 112. Reconsideration and withdrawal of the § 112 rejection are respectfully requested.

Prior Art Rejections

The Examiner has rejected claim 1 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,344,607 of Gonya et al. ("Gonya"). Further, the Examiner has rejected claim 2 under 35 U.S.C. § 103(a) as being unpatentable over JP 2000-126890 ("JP '890"). The Examiner has further rejected claims 1-6 under 35 U.S.C. § 103(a) as being unpatentable over JP 2003-082430 ("JP '430") and has rejected claims 3 and 5 under 35 U.S.C. § 103(a) as being unpatentable over JP 11-40025 ("JP '025") in view of an article by Lee et al. ("Lee"). Claims 4 and 6 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '025 in view of Lee and further in view of JP 2001-266724 ("JP '724") and claims 7-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '025 in view of Lee and/or JP '724 and further in view of JP 11-306940 ("JP '940"). Finally, claims 11-18 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '025 in view of Lee, JP '724, JP '940 and JP 40-3110732 ("JP '732"), and claims 23-38 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '025 in view of Lee, JP '724, JP '940, JP '732 and GB 2028608 ("GB '608"). Applicant respectfully traverses these rejections and the arguments in support thereof as follows, and respectfully requested reconsideration and withdrawal of the rejections.

Rejection Under § 102(b) Based on Gonya

The Examiner argues that claim 1 is anticipated by Gonya. Claim 1 has been canceled, rendering this rejection moot. Withdrawal of the § 102(b) rejection is respectfully requested.

Rejection Under § 103(a) Based on JP '890

Regarding claim 2, the Examiner argues that JP '890 teaches materials having amounts of Sn, Bi, In, Ag, Cu, and/or Sb which overlap with the claimed ranges, and that it would have been obvious to select the claimed ranges from those taught by JP '890. Claim 2 has been canceled, rendering this rejection moot. Withdrawal of the rejection is respectfully requested.

Rejection Under § 103(a) Based on JP '430

Regarding claims 1-6, the Examiner argues that JP '430 teaches an alloy type thermal fuse consisting of Bi, In, and Sn and another alloy having amounts of Bi, In, Sn, and Cu which overlap with the claimed invention. The Examiner argues that it would have been obvious to select the desired amounts of the respective elements from the ranges of JP '430. Applicants respectfully traverse this rejection as follows.

The publication date of JP '430, March 19, 2003, is subsequent to the priority date of the present application, the November 26, 2002 filing date of the JP 2002-342066 priority document. Enclosed herewith is a verified English translation of JP 2002-342066. Since at least rejected claims 1-6 are fully supported in the priority document, JP '430 does not qualify as prior art again the rejected claims, and withdrawal of the § 103(a) rejection is respectfully requested.

Rejections Under § 103(a) Based on JP '025 in view of Lee and further in view of JP '724, JP '940, JP '732 and/or GB '608

Regarding claims 3 and 5, the Examiner argues that JP '025 teaches an alloy type thermal fuse which includes a material having an alloy composition containing 35 to 48 weight percent Sn, 0.3 to 6 weight percent Bi, and about 26 to about 55 weight percent In. The Examiner concludes that it would have been obvious to select the claimed amounts of Sn, Bi and In from the ranges disclosed by JP '025. Further, the Examiner argues that the cadmium in the alloy of JP '025 would inherently be non-harmful to a living body (i.e., marine phytoplankton), as taught by Lee.

Regarding 4 and 6, the Examiner acknowledges that JP '025 does not specify adding 0.1 to 3.5 weight parts of Ag to the alloy composition of claim 1, but argues that JP '724 teaches adding such amounts of Ag to a similar fuse thermal fuse composition to lower resistivity, and thus concludes that it would have been obvious to add Ag to the JP '025 material.

Regarding claims 7-10, the Examiner acknowledges that JP '025 does not teach or suggest that at least a portion of the lead conductors would be covered with an Sn or Ag film. However, in view of the alleged teaching of JP '940 of applying a Sn or Ag film to the surface of lead conductors to improve their bonding strength, the Examiner concludes that the claimed invention would have been obvious based on JP '025 in view of JP '940.

Further, concerning claims 11-18, the Examiner acknowledges that the proposed combination of JP '025 with Lee, JP '724, and JP '940 does not teach that the ends of the lead conductors have a disk-like shape and that ends of the fuse element are bonded to front faces of the disks. However, JP '732 allegedly teaches providing lead conductors with a disk-like shape at the ends of the lead conductors and bonding the fuse elements to the front faces of the disks in order to prevent flux from adhering to the ends of the cylindrical case and to achieve quick separation when the fuse is activated. Therefore, the Examiner argues that it would have been obvious to combine these attributes, as taught by JP '732, with the proposed JP '025/Lee/JP '724/JP '940 fuse element to arrive at the present invention.

Finally, regarding claims 23-38, the Examiner acknowledges that the cited references do not teach providing a heating element for fusing off the fuse element. However, GB '608 allegedly teaches providing a resistor to blow a thermal fuse in order to terminate heating in a circuit for an electric blanket. Therefore, the Examiner concludes that it would have been obvious to one having ordinary skill in the art at the time of the invention to modify the JP '025/Lee/JP '724/JP '940/JP '732 combination by providing a resistor to blow a thermal fuse to terminate heating in a heating circuit. Applicant respectfully traverses these § 103(a) rejections as follows.

The presently claimed invention is directed to an alloy type thermal fuse which uses a particular alloy composition as the material for the fuse element. This alloy composition contains Sn, In, and Bi in specified amounts, and does not contain any elements which are harmful to living bodies when included in electrical or electronic devices. As previously explained, these restricted elements are set forth, for example, in the European Union RoHS directive (see Appendices 1 and 2). Accordingly, elements such as cadmium, which is known to impair liver function and cause brain damage, is not intentionally included in the presently claimed compositions. The thermal fuses according to the presently claimed invention thus achieve the goal of environmental conservation by protecting both individuals involved in the manufacturing of the thermal fuses and the end-users who handle them.

In contrast, JP '025 teaches an alloy-type thermal fuse using an alloy composition containing 0.3 to 6% Bi, 10 to 18% Cd, 35 to 48% Sn, and remainder (about 26-55 %) In. Including Cd in this alloy as a major component narrows the solid-liquid coexistence region to 4°C and reduces the dispersion of the operating temperature of the resulting thermal fuse.

The Examiner argues that the cadmium taught by JP '025 would inherently be non-harmful to a living body, as allegedly taught by Lee. Applicant strenuously traverses this conclusion.

Lee teaches that when zinc is limited, cadmium can act as an algal nutrient for species such as marine diatoms (single-celled algae), chlorophytes (green algae), and prymnesiophytes (unicellular marine flagellates), all various types of marine photoplankton. However, Lee also teaches that "very low concentrations of inorganic cadmium that are beneficial under conditions of moderate zinc-limitation become toxic in cultures severely limited by zinc." Therefore, cadmium can be toxic, even for marine phytoplankton.

However, the intent of the present invention is not to exclude elements which are harmful to photoplankton, but to exclude elements which would be harmful to people who come into contact with thermal fuses, either via manufacturing or direct use. As previously shown, Cd is known to be extremely toxic when included in electronic and electrical devices, and thus has the lowest maximum allowed concentration of any restricted element in the RoHS directive. Accordingly, the Cd in the JP '025 alloy would not be inherently non-harmful, as asserted by the Examiner, but actually would be quite toxic since it is included in an amount of 10-18%, dramatically greater than the maximum amount of 0.01% which is deemed acceptable by RoHS, for example. The Examiner's conclusion regarding the thermal fuse of JP '025 is thus wholly incorrect.

In sum, since JP '025 teaches an alloy composition which contains 10-18% Cd and is clearly not concerned with environmental concerns or intentionally excluding elements which are known to be harmful when included in fuses or similar devices, JP '025 does not teach or suggest all of the claimed elements. In fact, by including such a large concentration of Cd, JP '025 teaches away from the presently claimed invention, which is designed to protect the people who come in contact with thermal fuses.

For these reasons, no *prima facie* case of obviousness has been established based on JP '025.

Finally, regarding the dependent claims, even the proposed combinations of JP '025 with JP '724, JP '940, JP '732 and/or GB '608 would not cure the deficiencies with JP '025. Specifically, none of these references teaches excluding Cd or other elements which would be harmful to a living body. In fact, JP '940 teaches that the alloy composition may contain Pb or Cd, which are both known to be harmful to humans and are limited by the RoHS directive, for example. Rather than curing the deficiencies with JP '025, each of the secondary references is cited by the Examiner for teaching structural features (such as a heating element or a Sn or Ag film) which the Examiner acknowledges are not taught or suggested by JP '025. Therefore, even if any of the proposed combinations of JP '025 with JP '724, JP '940, JP '732 and/or GB '608 were proper, the combinations would not result in the presently claimed invention.

For all of these reasons, reconsideration and withdrawal of the § 103(a) rejections based on JP '025 alone or in view of JP '724, JP '940, JP '732 and/or GB '608 are respectfully requested.

In view of preceding Amendments and Remarks, it is respectfully submitted that the present claims are in full compliance with § 112, patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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Enclosures: Appendices 1, 2, 3, and 4
Verified Translation of JP 2002-342066